CENTRAL VALLEY FLOOD MANAGEMENT PLANNING PROGRAM

FloodSAFE CALIFORNIA

Central Valley Flood Protection Plan

Round 1 Management Action Workshops
Draft Initial Management Actions

A management action is a specific structural or nonstructural strategy, action, or tactic that contributes to the Central Valley Flood Protection Plan (CVFPP) goals and addresses identified flood management problems in the Systemwide Planning Area, including any identified deficiencies in the State Plan of Flood Control (refer to *CVFPP Interim Progress Summary No.1*). Management actions may range from potential policy or institutional changes, to recommendations for operational and physical changes to the flood management system. Management actions may address one or more CVFPP goals and are the "building blocks" for regional solutions and eventually systemwide solutions.

An initial set of management actions was developed by consolidating a large number of compiled actions and recommendations from published studies and reports, and input from Regional Conditions and Topic Work Groups during CVFPP Phase 1 activities. DWR subject-matter experts provided a preliminary evaluation of the environmental, economic, technical, and social consideration of the identified management actions. Each management action was evaluated against a uniform set of criteria to allow for a consistent comparative analysis.

Management Actions Workshops will refine the initial management actions and develop additional actions to augment this initial set of management actions. For information on Phase 2 Workshops, refer to *Attendee's Guide to Phase 2 Workshops* available at www.water.ca.gov/cvfmp/.

Each management action is evaluated using the *Management Actions Evaluation Form*. For description of the form sections refer to the *Reader's Guide to the Management Actions Evaluation Form* available at www.water.ca.gov/cvfmp/.

To provide detailed written comments on the management action description and evaluation, use the fillable PDF *Comments Form* available at www.water.ca.gov/cvfmp/.

Draft Storage Operations Management Actions

ID	Management Actions Title
MA-011	Establish partnerships to coordinate flood management structure operations.
MA-012	Increase flood management flexibility through modifications to the magnitude/timing of flood reservations in reservoirs.
MA-013	Increase flood management flexibility through modifications to objective release schedules at flood management reservoirs.
MA-014	Increase flood management flexibility by implementing conjunctive use programs at flood management reservoirs.
MA-015	Increase flood management flexibility by using transitory storage.

DRAFT Management Action Evaluation

Management Action Title: MA-011

Establish partnerships to coordinate flood management structure operations.

Description:

Problem:

The operations of flood management facilities are not always coordinated between regions or agencies and do not necessarily serve multiple uses. The Lower San Joaquin River Region is an example in which systemwide coordinated operations are needed to prevent downstream flooding from prescribed releases. Lower San Joaquin River levee and diversion systems are not capable of containing the objective release (maximum control release that can be safely conveyed by downstream channels) from all major, upstream project reservoirs simultaneously due to reductions in channel capacity from sedimentation, debris, and vegetation. Current flood operations can also adversely impact ecosystem function and habitat requirements as mandated by Biological Opinions or other regulations for water quality, downstream temperatures and species migration. Climate change, water supply, conjunctive use and transient storage are also not considered during current operations.

Desired Outcome:

Modify operation and enhance coordination of existing structures to provide better management of floods while serving multiple uses of the system.

Methodology:

Use new and existing partnerships to coordinate flood management structure operations. For example, the Reservoir Coordinated Operations Section and the Hydrology Branch of the Hydrology and Flood Operations Office have embarked on a Forecast Coordinated Operations initiative, in partnership with the USACE, NWS, and individual reservoir operators, to develop the means for interagency coordination of reservoir releases. Ensure all flood relief structures are operated and maintained as designed to preserve systemwide operational integrity. Operations of all facilities should be coordinated to reduce downstream impacts and serve multiple uses within the system. System models could be used to verify results of proposed operations in real time to assist in coordination of operations to achieve these goals.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify candidate off-stream sites where expanding storage is feasible and the off-stream reservoir is able to work in conjuction with existing flood management reservoir.

Advantages:

- Will work well in conjunction with other MAs that increase upstream system capacity and/or strengthen levees
- Low cost
- High value to water supply management.
- High value to ecosystem support if floodplains are used in reoperation scenarios.

Disadvantages:

- May result in water supply, environmental, and recreation impacts.
- Interagency coordination on multiple levels can be difficult and time consuming.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

May increase O&M costs if current O&M is not up to standards. Would also result in potential reduced flood damage costs; potential water supply cost savings.

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply). Potential also for local agency or reservoir operator to cost share.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Effect on Floodplain and Economic Development?

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding. Will not reduce frequency of floods in floodplains or bypasses but could reduce likely damaging floods by better flood water management between reservoirs and floodplains/bypasses/detention basins.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

System reoperations can only go so far in benefits if it is limited only to operations of reservoirs. System Reoperations is the key component to developing multibenefit scenarios between flood management and water supply protection and environmental benefits through remanaged floodplains in strategic locations. Floodplain activation frequency is a key ecological function in the CV that can sustain listed fish and wildlife species.

Adverse Environmental Impact?

None

Permitting Considerations?

FERC relicensing considerations for certain faciilities, potentially significant CEQA/NEPA requirements, additional flood easements may require new permitting or authorization

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Yes new opportunities will be provided to reduce O&M with the new management plans.

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features). Also would increase water supply security and public resources protection and enhancement.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply by reducing need for additional flood management storage. Would create or maintain environmentally functioning open-space or agriculturally beneficial open space.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Institutional and political challenges exist.

Technical Considerations:

Redirected Hydraulic Impacts?

This management action attempts to manage cumulative downstream impacts from flood management facilities and also has hydraulic impacts to conjunctive use opportunities or environmental land or river systems and the Delta.

Residual Risk?

The objective of cooridnated operations would be to reduce the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

This action could enhance hydrologic adaptability by incorporating climate change scenarios in operations and by increasing flexibility of water management.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

This is relevant to the entire CV as every main water supply-flood management reservoir will play some role at some time to manage flood water releases or manage for improved water supply conjunctive use options.

Integration with Other Programs:

Need planning coordination with FESSRO conservation strategies as well as DIRWM or Conjunctive use programs. This should consider coordination with outside agency programs as well (ACOE, USBR, USFWS, NOAA, DFG)

References:

DRAFT Management Action Evaluation

Management Action Title: MA-012

Increase flood management flexibility through modifications to the magnitude/timing of flood reservations in reservoirs.

Description:

Problem:

Reservoir operations conducted by many Federal, State and local agencies are largely governed by water control manuals specific to each reservoir. These water control manuals guide operational decisions on the timing and amount of flood space throughout the year and establish objective releases. Operational constraints imposed by manuals can make systemwide, multipurpose coordinated operations and goals difficult to accomplish.

Desired Outcome:

Provide better utilization of existing flood management and conservation storage for flood management.

Methodology:

Work cooperatively with local entities to explore how changes to the flood reserve space can improve flood management flexibility. One example of this is the Sacramento Area Flood Control Agency's (SAFCA) purchase of additional storage space in Folsom reservoir as one means of obtaining more flood space. Modifications to reservoir rule curves could be made to specify additional downstream control points and require the coordination with operations of other reservoirs. System models should not only be used to verify results but model application should be further extended to develop new rules of operation. System models could be used to verify results of proposed operations in real time to assist in coordination.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify reservoirs where reoperation may be feasible.

Advantages:

- Will work well in conjunction with other MAs that increase upstream system capacity and/or strengthen levees
- Low cost -High value to water supply management High value to ecosystem support if floodplains are used for storage in reoperation scenarios.
- High value to recovery of listed anadromous fishes if passage is a reoperation design criteria

Disadvantages:

- Modification of reservoir operations may affect water supply, hydropower generation (which is a function of storage in the reservoir), environmental flows and temperature, and recreation.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low initial investment

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs from reservoir reoperation.

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

Better flood protection may encourage floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Reservoir reoperations could be beneficial to restoring fluvial geomorphic processes needed by certain species, and thereby also enhance the ecological functions of aquatic and floodplain habitats. Modifying reservoirs to provide fish passage (new system operations) above major dams would provide significant water supply cost reductions and could lead to the recovery of listed fish species that currently restrict water supply, while allowing reservoirs to manage for water supply and floods more effectively.

Adverse Environmental Impact?

None

Permitting Considerations?

Approving modified system rule curves is a major undertaking with ACOE

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Any reoperation that reduces frequency of flooding and improves level of flood protection would have no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Possible positive or negative impact to reservoir recreation benefits depending on higher or lower carryover storage following end of flood season. Major benefits to the recovery of anadromous fish species if reservoirs are modified or allowed to pass fish into the upper watersheds. Also would provide water supply benefits by allowing anandromous fish to access historic habitat and reduce water costs below dams.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Modifying reservoir control manuals for flood management reservoirs would be difficult, but would generally have a higher likelihood of implementation than constructing new on- or off-stream storage. However, institutional and political challenges exist.

Technical Considerations:

Redirected Hydraulic Impacts?

Reoperation would likely have redirected downstream impacts, but they would include reduction in stage during flood operations.

Residual Risk?

The objective of reoperation would be to reduce the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

Modification of operations at flood control reservoirs could enhance hydrologic adaptability by increasing flexibility of water management, particularly if climate change scenarios are incorporated in operations. This action could also enhance biological adaptability by increasing the extent and quality of some aquatic and floodplain habitats, and thus, increase the ability of species to handle and adjust to the consequences of climate change.

Urban, Small Community, and Non-Urban Considerations:

Each of these areas is of some concern to Res ReOps coordination with a purpose of reducing flood risk to as many populated areas as possible. This will concern non-urban areas especially as some of these areas may need to be considered for alternative areas for floodwater transient storage or detention as part of coordinated reoperations.

Regional Applicability:

Applicable in all regions that have flood management reservoirs.

Integration with Other Programs:

Reservoir reoperation studies (HAFOO, future program), Forecast-Coordinated Operations Program (HAFOO) including the Yuba-Feather Forecast-coordinated Operationis Program, Forecast-Based Operations Program

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;Yolo Bypass Management Strategy; Agricultural Stewardship White Paper; RCR; Mokelumne/Amador/Calaveras IRWMP - Draft. November, 2006;

DRAFT Management Action Evaluation

Management Action Title: MA-013

Increase flood management flexibility through modifications to objective release schedules at flood management reservoirs.

Description:

Problem:

Reservoir operations are largely governed by water control manuals specific to each reservoir. These water control manuals guide the timing and amount of flood space throughout the year and establish objective releases (maximum controlled release that can be safely conveyed by downstream channels). Many downstream levee and diversion systems are not capable of containing the objective release of upstream reservoirs.

Desired Outcome:

Provide better utilization of existing flood management and conservation storage for flood management and protection of downstream lands and facilities.

Methodology:

Objective release schedules should be reviewed and revised if needed based on recent data and current watershed conditions. Modifications could provide more flexibility and safety systemwide and decrease the rate and quantity of reservoir encroachment. Decreasing the objective release would have the opposite effect, reducing downstream effects on facilities but also requiring a larger flood management reservation. Releases could be modified to increase the prescribed releases for a given level of forecasted inflow and percent of flood management space used.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify reservoirs where reoperation may be feasible.

Advantages:

- Will work well in conjunction with other MAs that increase upstream system capacity and/or strengthen levees
- Low cost

Disadvantages:

- Modification of reservoir operations may affect water supply

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low initial investment

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs from reservoir reoperation. Lower objective releases would likely result in lower maintenance costs to repair damage from frequent floods.

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Potential for moderate alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Substantial but less complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Any reoperation that reduces frequency of flooding and improves level of flood protection would have no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply by reducing need for additional flood management storage. Reservoir recreation benefits if higher carryover storage after flood season is over.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Modifying reservoir control manuals for flood management reservoirs would be difficult, but would generally have a higher likelihood of implementation than constructing new on- or off-stream storage. However, institutional and political challenges exist.

Technical Considerations:

Redirected Hydraulic Impacts?

Reducing objective releases would have redirected downstream impacts, but they would include reduction in stage during flood operations.

Residual Risk?

The objective of modification of objective releases would be to reduce the frequency of flooding, reducing residual risk to

existing development.

Climate Change Adaptability:

Modifying objective release schedules at flood control reservoirs could enhance hydrologic adaptability by increasing water management flexibility.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

Applicable in all regions that have flood management reservoirs.

Integration with Other Programs:

Reservoir reoperation studies (HAFOO, future program), Forecast-Coordinated Operations Program (HAFOO) including the Yuba-Feather Forecast-coordinated Operationis Program, Forecast-Based Operations Program

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-014

Increase flood management flexibility by implementing conjunctive use programs at flood management reservoirs.

Description:

Problem:

Reservoirs and transitory floodplain storage areas help regulate flood flows by attenuating or reducing the magnitude of flood peaks occurring in downstream channels. Currently, there is insufficient flood management storage available in existing flood management reservoirs to regulate flood flows to the extent needed/desired. Maintaining sufficient flood reservation space within reservoirs becomes critical during the rainy season, and maintaining that space results in mandated releases during the flood season (Hegedus and Shibatani, 2009). Conjunctive use projects may be able to use a portion of these mandated releases for groundwater recharge, where feasible. Current climate modeling suggests CA will experience higher peak flows during floods and greater need for water supplies, with possibly more severe droughts. As runoff patterns shift under climate change the ability to capture water after the flood season will diminish. Managing the combination of water supply and flood risk must use new methods to satisfy all the needs.

Desired Outcome:

Reduce flood risk and enhance water supply security by expanding the management tools and methods available.

Methodology:

Adding additional flood management storage allocation in an existing multi-benefit reservoir always results in a conflict with water supply storage allocation. This conflict may be alleviated by pre-storing the water supply allocation in a groundwater bank through conjunctive use operations. Pre-storing will be required because groundwater banks aren't able to take water in sufficient quantity to be used during flood operations. With the water stored in a groundwater bank, shortfalls that might result from the increase in flood management storage allocation could be replaced with water withdrawn from the groundwater bank.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify reservoirs where conjunctive use operations may be feasible.

Advantages:

- Would have other benefits such as water supply. This would be a way of providing more storage without building a new reservoir or enlarging a new dam.

Disadvantages:

- Some water may be lost permanently after recharge and, while creating more flood storage space, may not be recoverable for water supplies.
- Land may not be readily available for recharge.
- Surface storage has recreation benefits; redirecting storage to groundwater will diminish recreation benefits.
- Coordination between agencies and implementing land use changes would be challenging.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Moderate initial investment, depending on location and extent of facilities required to conduct conjunctive use operations (cost factors include real estate acquisition, conveyance and pumping facilities, and environmental mitigation costs). Costs would be distributed across multiple sources but primarily come from water supply and flood management funds. If range land restoration becomes a key component, long term restoration costs could be significant due to the large amount of range land, but unit costs for water and flood protection would be relatively low.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

O&M costs would likely increase significantly resulting from O&M for conjunctive use facilities, especially the pumping costs associated with accessing water supplies stored in groundwater banks.

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply). Also as multiple benefits are incorporated costs can be distributed across multiple programs and fund sources, so that coordinated cost sharing becomes the norm. If this measure happens it is not just a Corps flood project, but a true multi-benefit project.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery, and water supply shortages, through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding. Also, potentially restructures the runoff event, changing the potential for high risk floods.

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain. Some recharge areas may be sited on floodplains, so that these areas would be restricted in their development potential. The increase in water supply reliability should improve economic development, or at least make it more stable.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

N/A

Adverse Environmental Impact?

If new artificial recharge facilities are constructed in floodplains or agricultural lands, this action could result in moderate to substantial permanent impacts to terrestrial, agricultural, and potentially seasonal wetland habitats, including potential loss of habitat for special-status species. Changing a land use of any type has impacts.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Tempering peak flows has substantial O&M potential and to the extent that water supply capture can temper peak flows we have flood management cost savings.

Social Considerations:

Public Safety?

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to provide water supply benefits, given the ability to store excess flood waters, and then access them during dry periods.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Providing additional storage through conjunctive use would generally have a higher likelihood of implementation than constructing new on-stream storage, but institutional and political challenges exist.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within transitory storage inundation area.

Residual Risk?

Climate Change Adaptability:

Urban, Small Community, and Non-Urban Considerations:

xisting or new conjunctive use facilities may need to be sited in non-urban areas such as agricultural areas. There could also be opposition in areas where new facilities are placed.

Regional Applicability:

Applicable in all regions that have flood management reservoirs and available land and suitable geology for conjunctive use.

Integration with Other Programs:

A large number of opportunities for integrating with other needs.

References:

Mokelumne/Amador/Calaveras IRWMP - Draft. November, 2006; USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;Environmental Sustainability Summary; RCR; Boyle & Associates, 2008. Madera County Integrated Regional Water Management Plan;

DRAFT Management Action Evaluation

Management Action Title: MA-015

Increase flood management flexibility by using transitory storage.

Description:

Problem:

Reservoir operations are largely governed by water control manuals specific to each reservoir. These water control manuals guide the timing and amount of water release throughout the year. The current rule curves were developed based on the expected amount of historic flood flows and may not always allow the operational flexibility to allow for multiple uses, while conserving necessary space for flood waters. Climate change may affect future storm intensities and operations may need to be modified to accommodate the changing conditions. Additional storage space, such as transitory storage, should be evaluated to relieve some of the burden placed on system reservoirs by competing uses and needs.

Desired Outcome:

Increase available flood management storage and operational flexibility within the system by reoperating reservoirs in conjunction with downstream transitory storage areas.

Methodology:

Transitory storage occurs when peak flows are stored off-stream in adjacent areas until streamflows decrease and the water stored in transitory storage areas can flow back into the stream. Transitory storage can be natural, such as flows overtopping a bank and flowing into a wetland, or can be engineered using weirs and bypasses to direct flows onto lands or bypasses adjacent to the river. Transitory storage can attenuate flooding both locally and downstream and also would facilitate use of the flood system for multiple benefits, such as habitat or conjunctive use. Reoperation of a single flood management reservoir to take advantage of transitory storage would depend on the location of the transitory storage relative to the reservoir. If the transitory storage is a short distance downstream from the reservoir, then it may be possible to manage operations at the reservoir to optimize the effectiveness of the transitory storage. This ability is significantly reduced as the distance between the reservoir and the transitory storage increases due to travel time and additional inflows but could still be very useful if operation of reservoirs and transient storage is coordinated on a systemwide basis.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify reservoirs where operations to coordinate with transitory storage may be feasible.

Advantages:

- Takes advantage of natural areas.
- Alleviates burden on reservoirs and the need to build additional storage.
- Low cost
- Reestablishes regionally significant habitat in seasonal historic floodways, lowered flood risk to urban areas, and improved ability to manage larger flood events with lowered damages and less costly, quicker recovery over the long-term.

Disadvantages:

- Modification of reservoir operation to allow holding more flood water in conjunction with allowing transitory floodwater storage on floodplains can reduce potential impacts to water supply and even allow for potential improved conjunctive groundwater management.
- Impact maybe to lands that would have longer periods of flooding than current potentially.
- Transitory storage area may have an ecological impact.

• Also increases potential for recovery of listed anadromous fishes which would also reduce water supply restrictions currently faced by the State at Delta pump facilities.	Remediation may be required.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low to moderate initial investment, depending on location and extent of required construction to develop new transitory storage (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of new facilities)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs from modifications to existing dam facilities

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply). - Good to great potential for federal cost share for dam modifications or new bypass/floodplain acquisitions for ecosystem benefits and certainly cost share available if new floodplains are recreated due to setback levees for system improvements.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding. - Reduced with new floodplains, new dam facilities for flood release management options that could result in better flood management in the CV. Lower potential for catastrophic damages to water supply systems, urban or urbanizing areas, less damage to some ag areas (potential for easier/quicker recovery), lessen environmental damage and create opportunities for quicker recovery.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

May impact some floodplain development potential if in areas designated for transitory storage, but would also reduce flood risk to State overall.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Could rehabilitate physical processes and ecological functions if transitory storage is in historical floodplains and flood basins, including enhancing floodplain forming processes, and salmonid rearing and Sacramento splittail spawning habitat. - Physical and ecological functions have the potential to increase (or decrease too- ie. stranding splittail, fishes) depending upon timing and frequency of inundation, conditions, etc.

Adverse Environmental Impact?

If transitory floodplain storage is located in areas that are not active or historical fllodplains or floodbasins, this action could result in moderate to substantial permanent impacts to terrestrial, agricultural, and potentially seasonal wetland habitats, including potential loss of habitat for special-status species. Flooding for seasonal wetlands is what is needed to sustain these ecosystems and how they function as natural flood detention areas.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

With new transitory storage and/or floodplains or wetlands then the habitat benefits can possibly be offsetting for future O&M needs. Any new detention or seasonally flooded lands that also have native habitats allowed will could ultimately reduce the mitigation burdens for O&M on levees or in some cases in bypasses. This would be worked out in the system planning and permit process.

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to habitat restoration through wetting of floodplains in transitory storage areas. Many potential environmental and public open space benefits as long as access is permissible.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

High likelihood if looking for best use of funds for most multiple benefits to public safety, water supply reliability and significant endangered species and ecosystem function recovery. But most of all in consideration of the best management options for overall adaptation strategies for managing future climate change potential impacts to the State.

Technical Considerations:

Redirected Hydraulic Impacts?

Reoperation would likely have redirected impacts downstream INCLUDING OVERALL reduction in THE CHANNEL stage.

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

Reoperation in coordination with transitory floodplain storage would enhance hydrologic adaptability by increasing water management flexibility, and could enahnce biological adaptability if transitory storage is in historical floodplains and floodbasins (because in those locations it could increase the ability of aquatic and floodplain species to handle and adjust to the consequences of climate change).

Urban, Small Community, and Non-Urban Considerations:

Existing or new transitory storage facilities will need to be sited in non-urban areas such as wildlife refuges or agricultural areas.

Regional Applicability:

Not applicable in Delta Region, but may be used to reduce hydraulic impacts to Delta. Seasonal transitory flood areas would also contribute to national and international commerce through the use and benefits to migratory waterfowl and the industries around these resources.

Integration with Other Programs:

Flood Corridors Program (Projects Office). DIRWM regional water management grant applicants that are developing regional water supply and flood integration and habitat plans

References: